

HOSPITAL ENERGY ANALYSIS TOOLKIT (HEAT): USER MANUAL

**Stephen F. Weber
Barbara C. Lippiatt**

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Mathematics
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Gaithersburg, MD 20899**

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**U.S. DEPARTMENT OF COMMERCE
Robert A. Mosbacher, Secretary
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NIST

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ABSTRACT

The Hospital Energy Analysis Toolkit [HEAT] is a menu-driven microcomputer software program designed to help facility managers of existing hospitals evaluate the cost effectiveness of specific Energy Saving Methods (ESMs). The program estimates the energy savings and cost effectiveness of specific ESMs in a user-defined hospital environment. Hospitals are defined in terms of an unlimited number of actual functional space zones, each modeled after one of 21 prototype zones. For each defined zone, the user specifies the floor area, and for some zones the user specifies the types of heating and cooling systems, the percentage of space being actively used, and the window orientation. The user also defines an Energy Saving Plan by specifying the current and planned status of each energy parameter applicable to the particular zone. HEAT then computes and reports the energy and economic savings resulting from the Plan. A benchmarking function lets users compare current energy use of the entire hospital with national norms to see whether further analysis is warranted. HEAT offers easy-to-use menus and function keys, on-line help screens, and data validation.

Key Words: Cost effectiveness; decision support software; economic evaluation; energy conservation; hospitals; life-cycle cost analysis; microcomputer software

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We appreciate the helpful comments and suggestions we received from the hospital facility managers who served as Beta testers and from the NIST reviewers: Stephen Petersen, Dr. James Hill, and George Walton.

HOW TO INSTALL AND RUN HEAT

HEAT runs on an MS-DOS[™] microcomputer with at least 512 kilobytes of RAM and a hard disk drive. Before you can run HEAT, you must install it on a hard disk.

To install HEAT on a hard disk (for example on drive C):

1. Type `C:` and press `ENTER` to go to the hard drive on which HEAT is to be installed.
2. Insert diskette into drive A.
3. Type `A:INSTALL` and press `ENTER`. All the HEAT program and data files will be extracted and copied to a directory called `\HEAT` on drive C.

To run HEAT after installation on a hard disk (for example drive C):

1. Type `C:` and press `ENTER` to make the hard disk the current drive.
2. Type `CD\HEAT` and press `ENTER` to go to the HEAT directory.
3. Type `HEAT` and press `ENTER` to start the program.
[For monochrome graphic systems like the Compaq[™] Portable II or III, type `HEAT M` and press `ENTER`.]

To quit HEAT and return to DOS:

1. Return to the HEAT Menu with the Escape key and press `Esc` again.

NOTE: Because HEAT needs several files open at all times, you may have to change the "FILES=" statement in the CONFIG.SYS file located in the root of your hard disk. If an error message with the words "open error" appears at the top of the screen, you need to increase the value in the "FILES=" statement to 15 or greater. For example, if your CONFIG.SYS file has no "FILES=" statement or the CONFIG.SYS file is missing altogether, a message like "proc HOSP line 17, open error hospital.MEM(4)" will appear when you select the Hospital Data option of the HEAT Menu. Refer to your MS-DOS[™] manual for more information on the FILES configuration statement.

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1. INTRODUCTION AND OVERVIEW

The Hospital Energy Analysis Toolkit [HEAT] is a menu-driven microcomputer software program to assist facility managers of existing hospitals in evaluating the cost effectiveness of specific Energy Saving Methods (ESMs). The program estimates the energy savings and cost effectiveness of specific ESMs in a user-defined hospital environment. HEAT offers three analytical tools: (1) a benchmarking tool for hospital energy use; (2) an initial screening tool for ESMs; and (3) a tool to confirm the cost effectiveness of ESMs.

Benchmarking shows whether the current overall energy use of your hospital is in line with national averages for hospitals of similar configuration and size. The benchmarking results suggest how significant the energy saving opportunities are likely to be in your hospital. Even if your hospital uses less energy than the national average, however, some ESMs may still be cost effective, especially if fuel prices are relatively high in your area.

The screening tool lets you analyze specific ESMs using "best guess" preliminary cost estimates to identify the most promising ESMs for which bids should be sought. Finally, after the bids have been received, replace estimated with actual costs to confirm expected savings.

Once the program is started, the HEAT Menu appears with four options corresponding to four major steps in hospital energy analysis (Exhibit 1).

<h1>HEAT</h1> <p>Hospital Energy Analysis Toolkit</p> <hr/> <p>Hospital Data</p> <p>Zone & Energy Plan Data</p> <p>Energy Use Benchmark</p> <p>Results</p>
--

Use ↑ ↓ to select and press ←
F1 for Help Esc to Quit

Exhibit 1. HEAT Menu

The first step is to describe the hospital in terms of its location and fuel types and prices. The second step is to divide the hospital into space zones by selecting any combination of 21 possible energy zone prototypes. Then you may go directly to the third step -- compute the Energy Use Benchmark which compares actual energy use with national average consumption. If actual energy use exceeds national average consumption or fuel prices are particularly high in your area, then further analysis with HEAT is probably worthwhile. Return to step two and enter detailed Energy Saving Plans for each zone. For each Energy Saving Plan, HEAT estimates the energy savings and displays the economic results. Proceed to step four to review from a single table the energy and economic results of the Energy Saving Plans for every zone.

Press F1 for a summary of these major steps (Exhibit 2). Throughout HEAT press F1 to see help screens that explain the current procedures.

Main Modules of HEAT

Hospital Data

Specify the hospital location [ZIP code] and name, the number of years and first year in the analysis study period, the discount rate, and electricity price. Record the types of heating and cooling fuels, the fuel prices, and the average seasonal efficiencies of the systems.

Zone & Energy Plan Data

Describe details of your hospital by selecting any combination of the 21 possible energy zone prototypes. Enter the floor area for each zone and the type of heating/cooling system for most zones. For a few zone types you must also enter the percentage of area that is used and the main direction the windows face. Once all zones are defined, you may compute the Energy Use Benchmark or enter Energy Saving Plans by zone.

Energy Use Benchmark

Compare actual energy use with national average consumption by entering the monthly fuel consumption for each fuel type used. The Benchmark is meaningful only AFTER ALL hospital zones are defined since it is based on the floor area of each zone.

Overall Results

Display summary and detailed savings and costs for all hospital zones.

Press ←

Exhibit 2. Help Screen Explaining the HEAT Menu

2. HOSPITAL DATA

At the HEAT menu, select the module Hospital Data by moving the highlighted bar to this first option and pressing \leftarrow . A data entry screen appears (Exhibit 3).

Hospital Data	
Zip Code	44444
Hospital Name	St. Mary's
Length of Study Period [up to 30 years]	25
First year in Study Period	1990
Real Discount Rate [%]	7.00 [Interest rate less inflation.]
Current Electricity Price [\$]	0.075 / kWh
Heating Fuel	2
Cooling Fuel	1
	1 = Electric
	2 = Distillate
	3 = Residual
	4 = Natural Gas
	5 = Coal

F1 for Help \leftarrow or PgDn to Save Esc to Cancel

Exhibit 3. Entering Hospital-Wide Data

Enter the ZIP code where the hospital is located and its name. HEAT uses the first 3 digits of the ZIP to select the heating and cooling data files most closely resembling the energy needs of your location. There are six data files, each representing one city within the contiguous United States. The cities were selected as prototypical of a broad range of weather conditions. Your ZIP code is also used to identify your region for U.S. Department of Energy (DoE) energy price projections. Once you enter your ZIP code, HEAT identifies the heating and cooling data files it will use and your DoE Region (Exhibit 4).

Hospital Data

Zip Code 44444 DoE Energy Price Region: 2 City Used for 44444
 Heating Degree Days: 6600 CHICAGO
 Cooling Degree Hours: 800 CHICAGO
 Hospital Name St. Mary's

 Length of Study Period [up to 30 years] 25

 First year in Study Period 1990

 Real Discount Rate [%] 7.00 [Interest rate less inflation.]

 Current Electricity Price [\$] 0.075 / kWh

	Heating	Cooling
	Fuel Distillate	Electric
Seasonal Efficiency [%]	65	225
[With Distribution Loss]		
Current Unit Price [\$]	0.642 / gal	0.075 / kWh

F1 for Help ← or PgDn to Save Esc to Cancel

Exhibit 4. Entering Fuel Prices and System Efficiencies

Enter the Length and First Year of the analysis Study Period. The Length of Study Period is the longest time any of the Energy Saving Methods [ESM] are expected to be in force. Next enter the before-tax Real Discount Rate, which is the interest rate expected to be paid to finance the ESMs less your estimate of inflation. Thus, if your before-tax interest rate is 11% and inflation is about 4.5%, your Real Discount Rate is about 6.5%. Note that HEAT does not take into account any taxation effects of either the costs or energy savings of ESMs.¹

Next enter your electricity price and types of heating and cooling fuels. For Electricity Price enter the cost avoided from saving 1 kWh of lighting. Five types of fuels for heating and cooling are listed, each assigned a number code. These fuels are the only ones for which regional DoE energy price projections are available. Record the types of fuels the hospital uses for heating and cooling by entering the number code for each fuel. Distillate fuel oil includes No. 1 and 2 grade oils. Residual fuel oil includes No. 4, 5, and 6 grade oils.

¹Taxation effects should be ignored when analyzing non-profit hospitals. For software that does account for taxes, see the National Bureau of Standards Life-Cycle Cost (NBSLCC) microcomputer program, documented in Chapter 6 of Rosalie T. Ruegg and Stephen R. Petersen, Comprehensive Guide for Least-Cost Energy Decisions (Washington, DC: U. S. Government Printing Office, 1987).

Once you've identified the hospital's heating and cooling fuels, the lower part of the screen will ask for fuel prices and effective seasonal efficiencies of the heating and cooling systems (Exhibit 4). The effective seasonal efficiency estimate should include both energy conversion and distribution losses and is defined here as the percentage ratio of satisfied energy load to purchased energy, averaged over the heating or cooling seasons. Distribution losses may be significant if ducts are routed through unconditioned spaces. Oil and gas heating effective seasonal efficiency estimates vary from 30-90%. Electric resistance heating efficiencies vary from 50-90%. Effective cooling efficiency (equivalent to 100 times the Coefficient of Performance or C.O.P. less distribution losses) varies from 100 to 300%.

3. ZONE & ENERGY PLAN DATA

Once the hospital-wide data is recorded, the HEAT menu reappears. Now select the module Zone & Energy Plan Data. Divide the hospital into space zones, with each zone matching as closely as possible one of the 21 energy zone prototypes that are displayed when you press F4 (Exhibit 5). Press ↑ and ↓ to scroll through this screen. You may select the same prototype for more than one of the hospital's space zones. For example, the hospital may have two wings of patient rooms that you want to analyze separately, either because their orientation or HVAC system is different or because you want to study different Energy Saving Plans for each wing. After you select the zone prototype to represent a particular space, you may edit the name of the zone. For example, if you are modeling two wings of patient rooms differently, you may name them "Patient Rooms: West" and "Patient Rooms: East." However you edit a zone name, the analysis will always be based on the prototype zone you originally selected. Note that you may not need to use all 21 prototypes to describe your particular hospital.

ZONE DESCRIPTIONS						
ZONE TYPE	AREA SF	USED %	HVAC TYPE	WINDOWS FACE	SAVINGS PV\$	COSTS PV\$
Cent. Sterile Supply						
Corridors/Stairs/Elv						
Data Processing/Acct						
Emergency/Traum/Exam						
Engineer/Maintenance						
Food Service-Dining						
Food Service-Kitchen						
Housekp/Linen/Employ						
ICU & CCU Rooms						
Laboratories/Morgue						
Nursery/Delivery						
Office/Administrat'n						
Patient Rooms						
Pharmacy						
PT/OT/EEG/RT/PF						
Radiology Clinic						
Recovery Rooms						
Materials Management						
F1=Help F4=Add F5=Edit F6=Energy Plan Del=Delete Esc=Exit						

Exhibit 5. List of Energy Zone Prototypes

For each hospital zone you add, enter the floor area. If prompted, also select the type of heating/cooling system (HVAC) most closely resembling the system in the zone being modeled. You will be prompted to select the HVAC type only if HEAT has available more than one type for that zone prototype. For several zone prototypes you must also enter the percentage of area that is used (i.e., cannot be temporarily closed off) and the primary direction the windows face. The percentage area and window orientation questions are asked only if HEAT permits analysis of these variables for the zone prototype. Zones that are typically the largest are designed to permit analysis of these variables. Exhibit 6 gives the zone prototypes and configuration options for HVAC system, percentage area used, and window orientation that are available for each zone.

Zone Prototype	Zone Description	Configuration Option		
		HVAC Type ^a	Area Used	Windows Face
Cent. Sterile Supply	Central Sterile Supply	ALL		
Corridors/Stairs/Elv	Corridors, Stairs, Elevators	ALL	X	X
Data Processing/Acct	Data Processing, Accounting	ALL		
Emergency/Traum/Exam	Emergency, Trauma, Examining Room	ALL		
Engineer/Maintenance	Engineering, Maintenance Shops	HV		
Food Service-Dining	Food Service -- Dining Area	ALL		
Food Service-Kitchen	Food Service -- Kitchen Area	HV		
Housekp/Linen/Employ	Housekeeping, Linen, Employee Facilities	ALL		
ICU & CCU Rooms	Intensive and Critical Care Units	CVRH		
Laboratories/Morgue	Laboratories, Morgue	CVRH		
Nursery/Delivery	Nursery, Delivery Room	CVRH		
Office/Administrat'n	Offices, Administration Areas	ALL		X
Patient Rooms	Patient Rooms	ALL	X	X
Pharmacy	Pharmacy	ALL		
PT/OT/EEG/RT/PF	Physical & Occupational Therapy, Electroencephalograph, Radiation Therapy, Pulmonary Function	ALL		
Radiology Clinic	Radiology Clinic	ALL		
Recovery Rooms	Recovery Room	CVRH		
Materials Management	Materials Management (Stores)	UH		
Support/Nurse Stat'n	Support Areas, Nurses Stations	ALL	X	
Surgery Rooms	Surgery Rooms	CVRH		
Surgery Support Areas	Surgery Support Areas	ALL		

- ^a ALL: CVRH -- Constant Volume Reheat, DDMZ -- Dual Duct or Multi-zone Unit, VAVR -- Variable Air Volume Reheat, and FCU -- Fan Coil Units
 HV: Heating and Ventilating Unit (heating only unit)
 CVRH: Constant Volume Reheat
 UH: Unit Heater (heating only unit)

Exhibit 6. Zone Prototypes and Available Configuration Options

While defining zones, press F5 to edit any of the entries and Del to delete any zone entirely. Once all zones are defined, you may either Benchmark your energy use or enter and analyze Energy Saving Plans by zone. To Benchmark, press Esc for the HEAT menu and then select **Energy Use Benchmark** (see next section). To analyze a zone, move the cursor to highlight it and press F6.

Now enter data describing the Energy Saving Plan you would like to analyze for that zone (Exhibit 7). For each zone, you will be offered up to 10 Energy Saving Methods [ESMs] to select. The particular ESMs available for a zone depend on engineering judgment regarding their appropriateness for the zone. For example, zones that are typically situated in interior space are not offered the two window-related ESMs. For Lighting Hours enter the number of hours per week you plan to reduce lighting time. Enter the Status Now and Planned for the other ESMs available for the zone. The Status values are set initially to the most likely values for each zone, and your entries are limited to ranges reasonable for each zone and ESM. HEAT cannot estimate energy usage for values outside these reasonable ranges.

ENERGY SAVING PLAN for Patient Rooms						
METHOD	NOW	PLAN	COST	LIFE	AREA	
LIGHTING: ON Hours Reduced per week	NA	7	0	25		
Watts per SF	3.04	3.04	0	25		
ROOFING: Insulation U-Value	0.080	0.040	4000	25	4000	
WINDOWS: Shading coefficient	0.60	0.60	0	25	2000	
Glazing U-Value	1.00	0.60	20000	25		
OUTSIDE AIR: Percent of total	20	20	0	25		
COOLING COIL: Discharge Temp. (°F)	58	59	0	25		
ECONOMIZER: Y(es) or N(o)	N	N	0	25		
VARIABLE AIR VOLUME: Y(es) or N(o)	N	N	0	25		
UNUSED AREAS CLOSED: Y(es) or N(o)	N	Y	0	25		

For each ESM enter Status Now & Planned, Cost(\$), Life(YR), and Area(SF).
F1=Help PgDn=View Zone Results Esc=Exit

Exhibit 7. Entering Energy Saving Plan for Patient Rooms Zone

Enter the expected Cost, if any, of installing or initiating each ESM. If the ESM must be replaced one or more times before the end of the Study Period, change the life to reflect the time between replacements. The replacement cost is assumed to be the same as the current initial cost in constant dollars. For

example, if the Life is 10 years and the Study Period is 30 years, the Cost will be incurred three times (once now, and at the end of years 10 and 20). The Cost, Life, Study Period, and Real Discount Rate are used to compute the Present Value Cost of the ESM. If the ESM is expected to last through or beyond the Study Period, replacement is unnecessary so leave the Life equal to the Study Period.

For roof and window ESMs, enter the Area in square feet to be treated. The Roof Area may not exceed the floor area of the zone, and the Window Area may not exceed twice the floor area of the zone.

To exclude an ESM, enter the same (i.e., its current) value for both Status Now and Planned and leave the Cost at zero and the Life equal to the Study Period.

When the Energy Saving Plan is complete, press PgDn to estimate the energy savings and display the economic results for that zone (Exhibit 8).

ENERGY AND ECONOMIC ANALYSES for Patient Rooms			
ANNUAL ENERGY SAVINGS BY ENERGY FUNCTION:			
Heating Distillate gal	Cooling Electric kWh	Other Electric kWh	TOTAL ENERGY All Fuels MBtu
5,586	52,699	28,046	1,050
ECONOMIC ANALYSIS			
PRESENT VALUE SAVINGS OVER 25 YEARS BY ENERGY FUNCTION:			
\$ Heating 56,140	\$ Cooling 46,045	\$ Other 24,505	TOTAL ENERGY \$ 126,689
PRESENT VALUE COSTS OVER 25 YEARS:			\$ 24,000
NET PRESENT VALUE SAVINGS OVER 25 YEARS:			\$ 102,689
			Press ←

Exhibit 8. Energy and Economic Results for Patient Rooms Zone

The top half of this screen reports the estimated energy savings per year due to the combination of ESMs selected. Energy savings are reported separately for heating, cooling, and other electricity (e.g., lights, fans, pumps, and plug-in equipment). The savings for these three functions are also summed to report

total annual energy savings in million Btu's. The bottom half of the screen reports the dollar savings over the Study Period attributed to these recurring energy savings, taking into account the fuel prices, discount rate, and system efficiencies. Also reported is the present value cost over the Study Period, which is the discounted sum of investment and replacement costs for all the ESMs. Finally, the difference between time-adjusted savings and costs, or net present value, is displayed. Press ← to return to the ZONE DESCRIPTIONS screen, now with present value savings and costs reported for Patient Rooms (Exhibit 9).

ZONE DESCRIPTIONS						
ZONE	AREA SF	USED %	HVAC TYPE	WINDOWS FACE	SAVINGS PV\$	COSTS PV\$
Cent. Sterile Supply	1500	100	CVRH	NA		
Corridors/Stairs/Elv	13000	95	CVRH	N/S		
Data Processing/Acct	1400	100	CVRH	NA		
Emergency/Traum/Exam	1100	100	CVRH	NA		
Food Service-Kitchen	4000	100	NA	NA		
Laboratories/Morgue	3000	100	CVRH	NA		
Office/Administrat'n	11000	100	CVRH	N/S		
PT/OT/EEG/RT/PF	3000	100	CVRH	NA		
Support/Nurse Stat'n	27000	95	CVRH	NA		
Patient Rooms	16000	95	CVRH	E/W	126689	24000
ICU & CCU Rooms	1700	100	CVRH	NA		
Surgery Rooms	2000	100	CVRH	NA		
Surgery Support Area	4800	100	CVRH	NA		
F1=Help F4=Add F5=Edit F6=Energy Plan Del=Delete Esc=Exit						

Exhibit 9. ZONE DESCRIPTIONS with Patient Room Energy Plan Results

You may want to analyze multiple Energy Saving Plans for each zone to compare energy savings and economic results. Keep in mind, however, that only the latest versions of your Hospital Data and Energy Saving Plans are saved by HEAT, so print data and results as you go by holding down the Shift key and pressing the PrintScrn key.

You may even change assumptions you made in the Hospital Data module to see the effect on results. After making changes to Hospital Data, however, be sure to update the energy and economic results stored in the file by pressing F6 from the ZONE DESCRIPTIONS table (Exhibit 5) and then pressing PgDn at the zone's ENERGY SAVING PLAN screen (Exhibit 7). Repeat this procedure for every hospital zone defined.

4. ENERGY USE BENCHMARK

From the HEAT menu select the module Energy Use Benchmark. A worksheet appears that may be used to check whether the current energy use of your hospital is in line with national averages for hospitals like yours. You simply fill in the monthly purchases of each type of fuel you use. The Benchmark is meaningful only after all hospital zones are defined, since it is based on the total floor area of all defined zones. Make sure that the total floor area matches the actual hospital area heated and cooled by the fuel consumption recorded.

After filling in your fuel consumption press F10 to display the totals and compare your consumption with a national Benchmark (Exhibit 10). Your fuel consumption is used to compute your hospital's actual Energy Use Index (EUI), measured in 1000 BTU per square foot per year. This Actual EUI is then compared with an estimate of a Normal (national average) EUI for a hospital with the same zones and same zone floor areas as yours. The percentage difference of the Actual to the Normal is displayed.

Energy Benchmark Worksheet					
	Electric (kWh)	Distillate (gal)	Residual (gal)	Nat. Gas (therm)	Coal (ton)
January	142940	10960	0	0	0
February	139660	11880	0	0	0
March	143225	10860	0	0	0
April	147330	10150	0	0	0
May	153220	9300	0	0	0
June	157890	8760	0	0	0
July	160840	8350	0	0	0
August	161840	7840	0	0	0
September	156230	8290	0	0	0
October	153150	8760	0	0	0
November	149780	9340	0	0	0
December	145360	9760	0	0	0
TOTALS in UNITS:					
	1811465	114250	0	0	0
TOTALS in MBTU:					
	6181	15845	0	0	0
TOTAL ENERGY USE: 22,026 MBTU/YR for 89,500 SF of Floor Space					
ENERGY USE INDEX BENCHMARK (KBTU/SF/YR)					
Actual:	246.10	Normal:	215.64	Difference:	14.1% Over
Enter monthly energy use by fuel. F10=Benchmark Esc=Exit					

Exhibit 10. Benchmarking Your Hospital's Energy Use

These benchmarking results suggest how significant the energy saving opportunities are likely to be in your hospital. Be aware, however, that even if your hospital uses less energy than the national average, some ESMs may still be cost effective, especially if fuel prices are relatively high in your area.

5. RESULTS

This module displays in a single table the energy and economic results of the Energy Saving Plans for every zone (Exhibit 11). The annual savings of energy used for Heating, Cooling, and Other Electricity are separately displayed. The economic results are displayed as the Present Values of all energy savings and of all Costs, discounted over the Study Period. The Net Present Value representing the difference between savings and costs is also shown in the far right column of the table.

ANNUAL ENERGY SAVINGS & ECONOMIC RESULTS BY ZONE						
ZONE	HEATING gal	COOLING kWh	OTHER kWh	SAVINGS PV\$	COSTS PV\$	NET PV\$
Cent. Sterile Supply	133	1197	1650	3826	1500	2326
Corridors/Stairs/Elv	6632	33440	25373	118043	42000	76043
Data Processing/Acct	197	1654	1828	5023	1400	3623
Emergency/Traum/Exam	0	455	1659	1847	0	1847
Food Service-Kitchen	0	0	3899	3407	4300	-893
Laboratories/Morgue	243	1931	3702	7360	2200	5160
Office/Administrat'n	1196	8123	14995	32215	10800	21415
PT/OT/EEG/RT/PF	113	1137	2672	4464	1200	3264
Support/Nurse Stat'n	4804	59324	45301	139696	19000	120696
Patient Rooms	5586	52699	28046	126689	24000	102689
ICU & CCU Rooms	1179	4791	4247	19741	4950	14791
Surgery Rooms	726	4143	7386	17374	2000	15374
Surgery Support Area	1337	5940	7044	24784	5400	19384
F1=Help F6=View Zone Results Esc=Exit						

Exhibit 11. Viewing Energy and Economic Results by Zone

To view the detailed energy and economic analysis results of any zone, use ↑ and ↓ to highlight the zone and then press F6. If any of the Hospital-wide data have been changed since the zone's Energy Saving Plan was developed, the energy and economic results must be updated before the results are correctly displayed in this Results module. For example, suppose you change one of your fuel prices. To update the results, return to the ZONE DESCRIPTIONS table (Exhibit 5) and press F6 and then press PgDn at the zone's Energy Saving Plan screen (Exhibit 7). This procedure must be followed for every zone defined.

HEAT evaluates the cost effectiveness of specific Energy Saving Methods (ESMs) applied to a user-defined hospital environment. The Benchmarking feature of HEAT shows whether the current energy use of your hospital is in line with national averages for hospitals of similar configuration and size. The benchmarking results suggest how significant the energy saving opportunities are likely to be in your hospital.

HEAT may be used initially with "best guess" estimates of ESM cost to evaluate alternative Energy Saving Plans and identify the most promising ESMs for which bids should be sought. Once bids have been received, rerun HEAT using actual ESM bid prices to better estimate cost effectiveness. For ESMs requiring a large capital investment, a qualified engineer should confirm the energy savings estimated by HEAT, based on a more comprehensive analysis of your hospital.

BIBLIOGRAPHIC DATA SHEET

4. TITLE AND SUBTITLE

Hospital Energy Analysis Toolkit [HEAT]: User Manual

5. AUTHOR(S)

Stephen F. Weber and Barbara C. Lippiatt

6. PERFORMING ORGANIZATION (IF JOINT OR OTHER THAN NIST, SEE INSTRUCTIONS)

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Rockville, MD 20857

10. SUPPLEMENTARY NOTES

☐ DOCUMENT DESCRIBES A COMPUTER PROGRAM; SF-185, FIPS SOFTWARE SUMMARY, IS ATTACHED.

11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.)

The Hospital Energy Analysis Toolkit [HEAT] is a menu-driven microcomputer software program designed to help facility managers of existing hospitals evaluate the cost effectiveness of specific Energy Saving Methods (ESMs). The program estimates the energy savings and cost effectiveness of specific ESMs in a user-defined hospital environment. Hospitals are defined in terms of an unlimited number of actual functional space zones, each modeled after one of 21 prototype zones. For each defined zone, the user specifies the floor area, and for some zones the user specifies the types of heating and cooling systems, the percentage of space being actively used, and the window orientation. The user also defines an Energy Saving Plan by specifying the current and planned status of each energy parameter applicable to the particular zone. HEAT then computes and reports the energy and economic savings resulting from the Plan. A benchmarking function lets users compare current energy use of the entire hospital with national norms to see whether further analysis is warranted. HEAT offers easy-to-use menus and function keys, on-line help screens, and data validation.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

cost effectiveness; decision support software; economic evaluation; energy conservation; hospitals; life-cycle cost analysis; microcomputer software

13. AVAILABILITY

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